PHOTONICS - EUROPHOTONICS MASTER COURSE

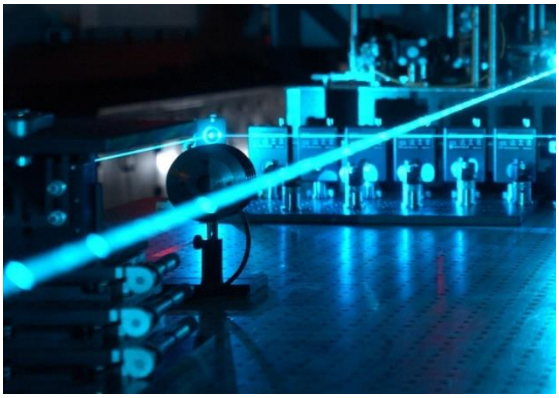
PROPOSAL FOR A MASTER THESIS

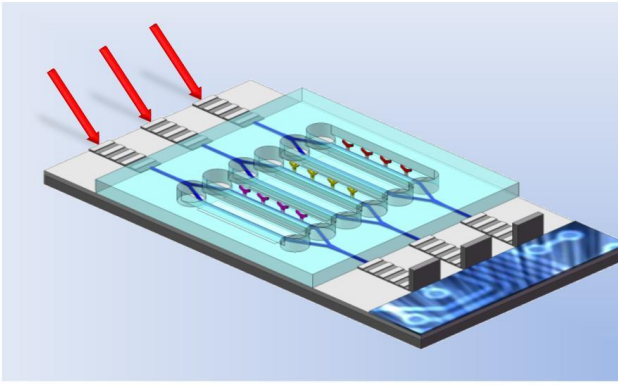
Dates : April 1st, 2014 – september 31th, 2014

Laboratory : Centre for Sensors, Instrumentation and systems Development (UPC-CD6)
City, Country : Terrassa, Spain

Title of the master thesis :

A plasmonic accuracy biosensor using a single laser diode





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Summary of the subject (maximum 1 page):

Self-mixing interferometry is a powerful, low-cost optical metrology technique where the nonlinear effects happening within a laser cavity under feedback are used to deliver high-accuracy experimental measurements of position, speed and frequency of vibration. The technique works by simply shining a laser beam against the object to be measured in order to get feedback inside the laser cavity out of the light backscattered at the target. Measurements of 30nm accuracy are obtained with just a laser diode quite easily. Under certain conditions, however, the technique can result in a very high accuracy one, with resolutions down to a few nanometers.

On the other side, there is a growing trend towards the use of low-cost, reliable devices for medical devices, in a trend to develop novel solutions for health monitoring in an ageing population. In particular, very high accuracy biosensors of low cost are needed for the next generation of lab-on-chip devices, where measurements of refractive index or concentration are critical in order to evaluate tiny changes due to the presence of antigens or undesired compounds.

The student working in this project will analyse the feasibility of a high-accuracy biosensor oriented to sense concentration sensor in lab-on-chip arrangements and/or controlled tissue phantoms based on a self-mixing interferometry approach. After a short introduction to the technique and its experimental constraints, and the analysis of the state of the art, the student will design build and test a novel concept of biosensor, test it, buld a first proof of concept demonstrator, and analyse its performance and future development.

Keywords : Self-mixing interferometry, optical feedback, lab-on-chip, biomedical optics, optical metrology, medical devices, health.

Additional information :

* Amount of the monthly allowance (if it is the case):
To be discussed depending on the value of candidate.

* Required skills :
Interest in application-driven experimental work for solving real-world innovation needs.
Basic concepts in optical metrology and optical engineering
Programming (C++, MatLab) and scientific software packages (Sigmaplot,...)
Search of resources, both scientific and technical
Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

* Miscellaneous :
International team with several years of experience in the technique proposed.
Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.
Possibility of joining the Centre for a PhD/Project Manager career in case of common interest.
Early incorporation welcome.